Psyche Additive Manufacturing

Team 501 - VDR 1

FAMU-FSU College of Engineering

Team Introductions

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Thermal Engineer

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Systems Engineer

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CAD Engineer

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Material and Design Engineer

Canaan St Lewis
Astronautical Engineer

Sponsor and Advisor

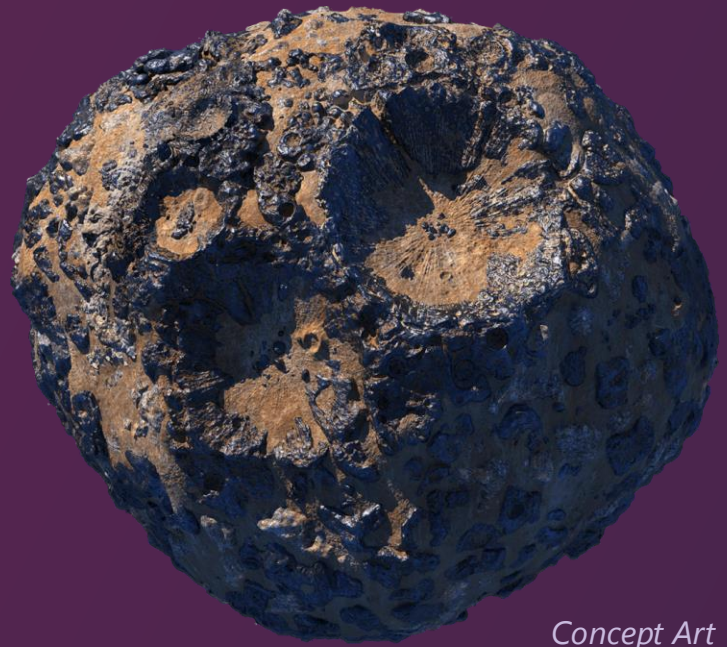
Dr. Cassie Bowman
Sponsor

Dr. Dorr Campbell
Advisor

Objective

The objective of this project is to additively manufacture critical components for a future mission to the Psyche asteroid, using the hypothesized metals lying on its surface.

Psyche Asteroid

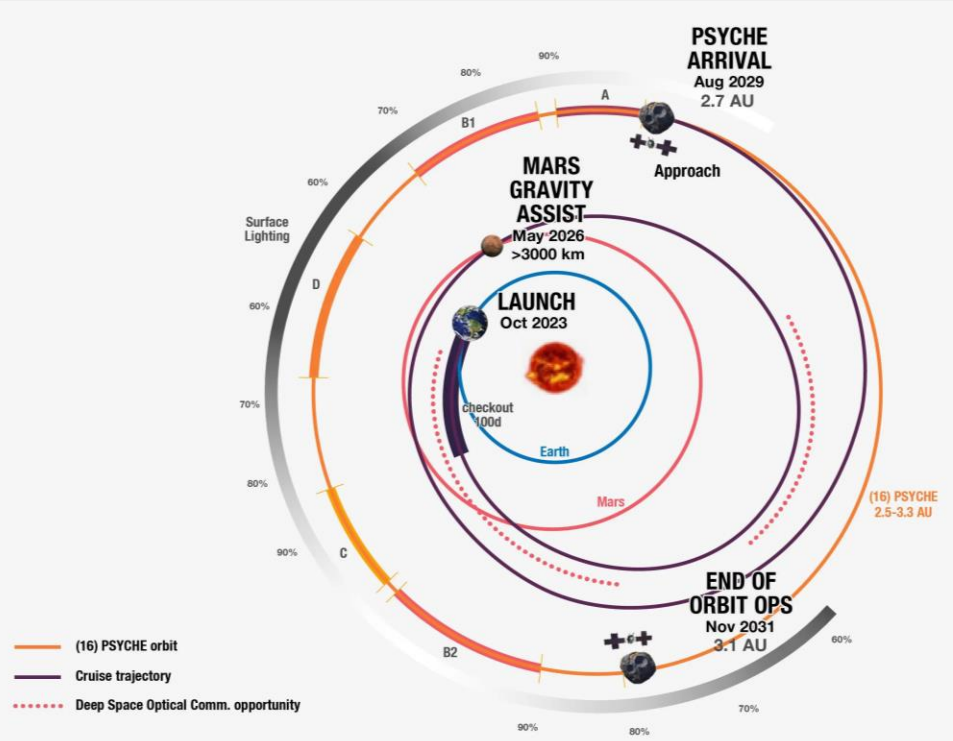


Concept Art

- The Psyche asteroid is hypothesized to be a remnant from a planetesimal.
- Across at its widest point, it has a diameter of 144 miles. Its surface area is 64,000 square miles.
- Best analysis indicates it is 30-60% metal in composition.
- Hypothesized metals inclue nickel, iron, and iridium
- The composition and sizing has been determined by radar and optical observations.

Psyche Asteroid

- Psyche mean surface gravity = 0.114 m/s^2
- Strange rotation causes for long months of darkness.
- A year on Psyche is around 5 earth years while a day is around 4.5 hours.
- The lack of an atmosphere subjects Psyche to harsh environments



Key Goals

- Integration
- Material Use
- Lifecycle

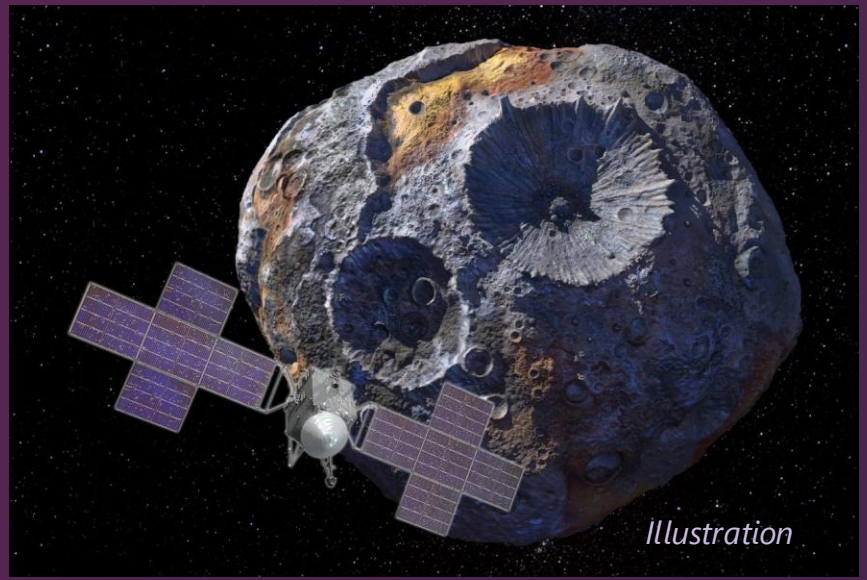
Key Goals

Repair

Standardize

Testing

Assumptions



- Arrival
- Mobility
- Power
- Repairability
- Unexpected Occurrences

Market

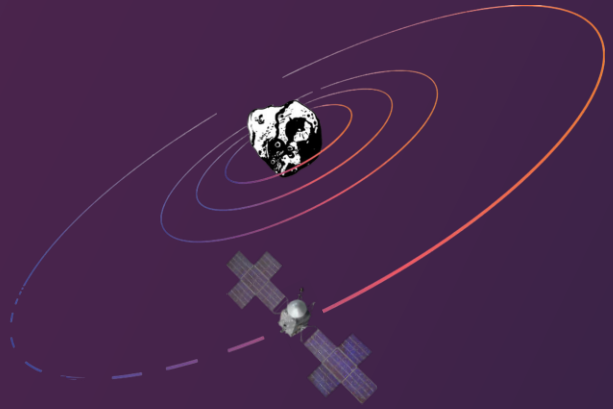
Primary

- NASA Psyche Mission
- Private Space Companies
- Government Agencies

Secondary

- Academic and Research Institutions
- Advanced Manufacturing and Aerospace Companies
- Space Tourism Companies

Customer Background



Psyche Mission

Objective: *Study the Asteroid*

- Phase A *Concept Study*
- Phase B *Preliminary Design*
- Phase C *Critical Design and Build*
- Phase D *Assembly, Test, Launch*
- Phase E *Cruise, Arrival, and Orbit*
- Phase F *Mission Closeout*

Customer Background

Future Psyche Mission

Objective: *Mine the Asteroid*

Phase A *Concept Study*	Phase B *Preliminary Design*	Phase C	Phase D	Phase E	Phase F

Customer Needs

Technical Specifications

The weight and volume of the device will be benchmarked off past devices that have been used on the ISS.

The system will be powered by an external power supply.

The system is immobile; it will be integrated into a separate mobility system.

The design will have a lifetime similar to that of products that exist for similar conditions.

Customer Needs

Regulatory Requirements

The system will be compliant with NASA's additive manufacturing requirements for in-space flight.

The final design will be manufactured at NASA and its participating contractor locations.

The naming of the system will be compliant with NASA and the FAMU-FSU College of Engineering's Code of Conduct

Customer Needs

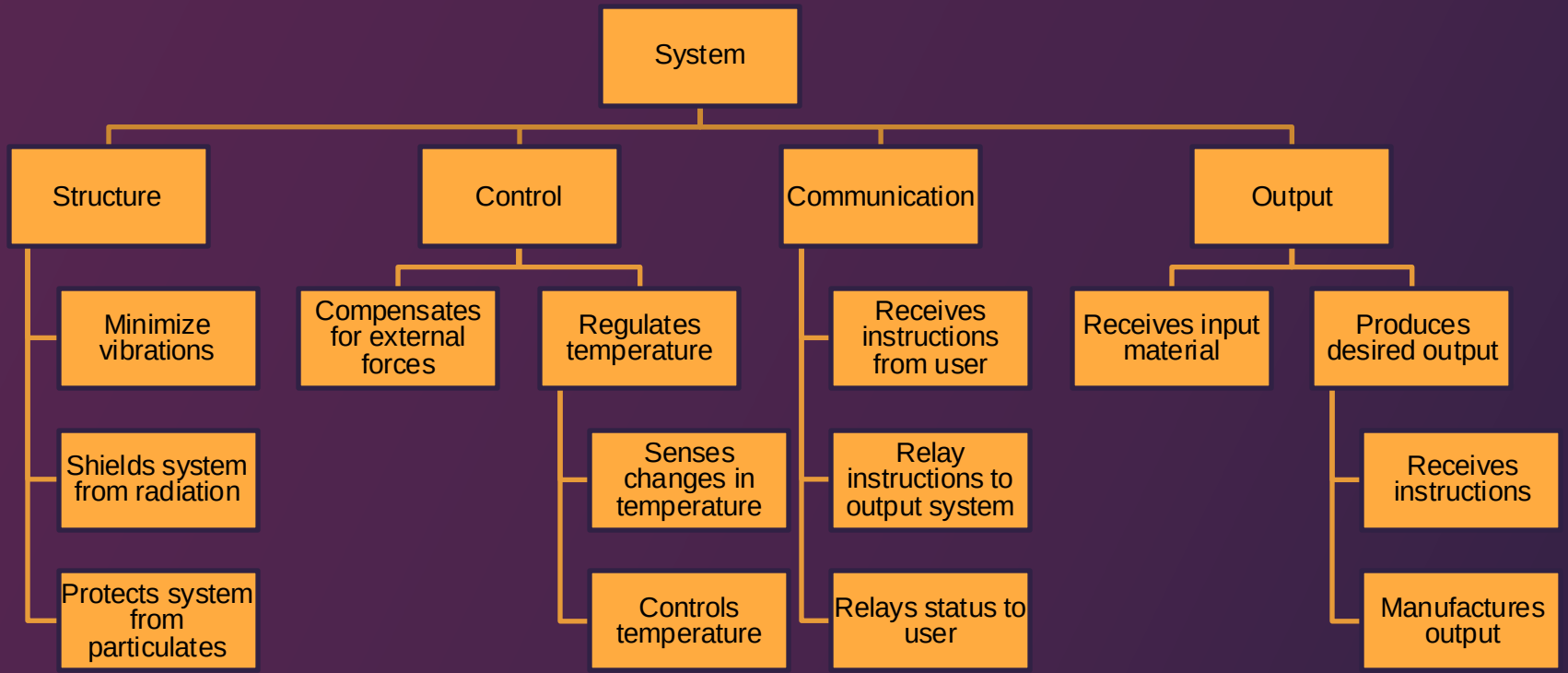
Documentation

Limitations will be considered with valid reasoning, supported by evidence, and documented as Future Work.

All public-facing work will comply with the NASA Psyche Mission Guidelines and the Psyche Brand Guide.

Virtual team meetings and communication through ‘Slack’ will be used to convey progress to the sponsor – per request.

Functional Decomposition



Future Work

- Location Analysis and Topography
- Temperature Analysis
- CAD Workshops
- Material Testing and Research
- Concept Generation
- Prototyping

References

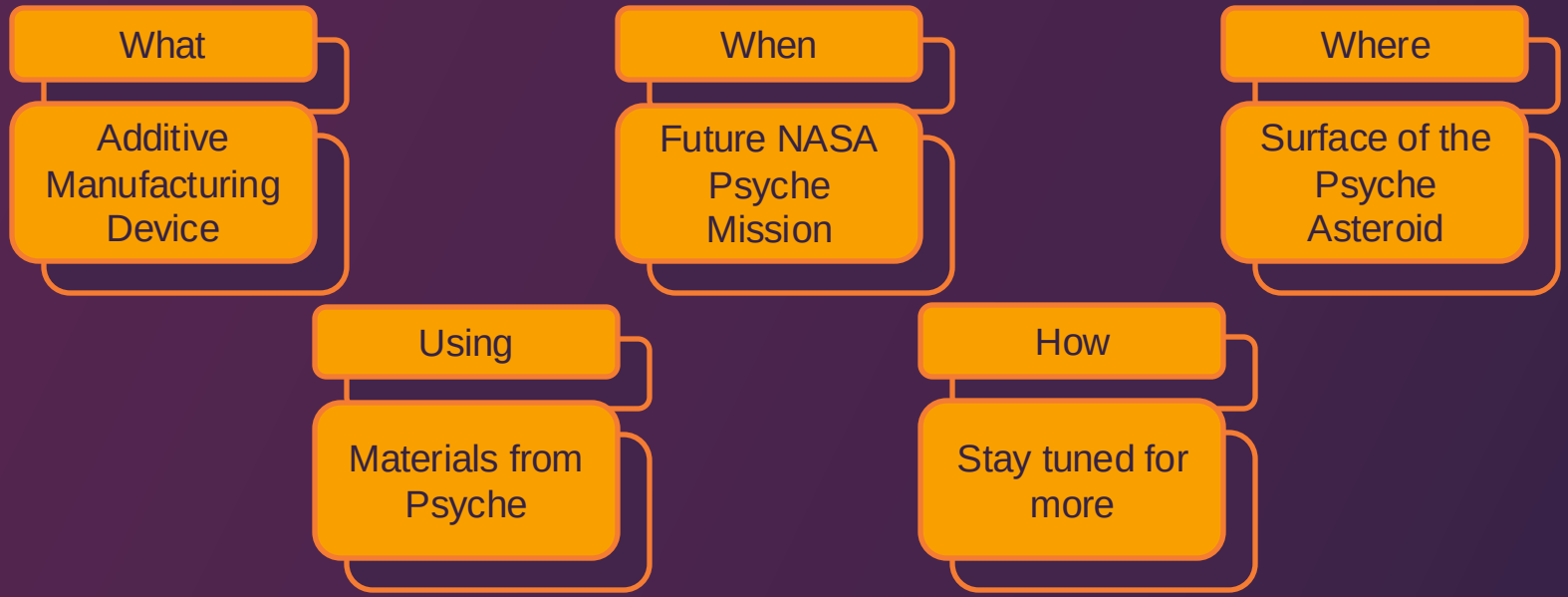
“Asteroid 16 Psyche: Psyche Mission - A Mission to a Metal World.” Psyche Mission, 13 Sept. 2023, psyche.asu.edu/mission/the-asteroid/.

“Psyche - NASA Science.” NASA, NASA, science.nasa.gov/mission/psyche/. Accessed 8 Oct. 2024.

Vedaraman, Sekar, et al. “How NASA’s Psyche Mission Will Explore an Unknown World We Can Barely Pinpoint from Earth.” SciTechDaily, 5 Oct. 2024, scitechdaily.com/how-nasas-psyche-mission-will-explore-an-unknown-world-we-can-barely-pinpoint-from-earth/.

“NASA Psyche Mission.” Design and Copy Guidelines, 1 June 2020, psyche.asu.edu/wp-content/uploads/2018/03/20200528_Psyche_BrandGuide-v2_6.1_20_rev-.pdf.

Conclusion


What
Additive Manufacturing Device
When
Future NASA Psyche Mission
Where
Surface of the Psyche Asteroid
Using
Materials from Psyche
How
Stay tuned for more